CLAIMS

WE CLAIM:

1.   A system for allowing a user to interact with a multi-agent distributed control system, the system comprising:

a computerized terminal on which is displayed a user interface, wherein the user interface includes

5   a first window displaying a workflow among a first plurality of agents of the multi-agent system.

2.   The system of claim 1, wherein the workflow is displayed as a tree-type diagram linking a primary agent of the first plurality of agents and at least one secondary agent of the first plurality of agents, wherein the primary agent created a work request and the at least one secondary agent performed at least one of

5   planning, commitment or execution of work in response to the work request.

3.   The system of claim 2, wherein the at least one secondary agent includes a second plurality of agents.

4.   The system of claim 3, wherein the tree-type diagram includes the primary agent, a first layer of the secondary agents that are directly in communication with the primary agent and a second layer of the secondary agents that are directly in communication with the secondary agents of the first layer.

5.   The system of claim 4, wherein the tree-type diagram includes a first plurality of arrows connecting the primary agent to each of the secondary agents of the first layer, and a second plurality of arrows connecting the secondary agents of the first layer with the secondary agents of the second layer, and wherein each of the

5   arrows represents at least one message between a respective pair of the agents.

6.   The system of claim 5, wherein one of the arrows represents a plurality of messages, the messages of the plurality are also listed in the first window.

7. The system of claim 1, wherein the user interface further includes at least one of:

a second window displaying a first list of messages sent between pairs of agents of one of the first plurality of agents and a second plurality of agents of the multi-agent system; and

a third window displaying a second list of work units requested by at least one of the agents of the first and second pluralities of agents.

8. The system of claim 7, wherein the user interface includes both of the first and second windows displaying the first and second lists.

9. The system of claim 7, wherein the user interface includes the second window, wherein across a top portion of the second window are listed the agents between which the messages of the first list were sent, wherein extending downward from each of the listed agents are respective vertical lines corresponding to the respective listed agents, and wherein a plurality of arrows representative of the messages between the listed agents connect the respective vertical lines corresponding to the listed agents between which the messages were sent.

10. The system of claim 9, wherein the first list also includes numbers, times and descriptions corresponding to the listed messages.

11. The system of claim 7, wherein the user interface includes the third window, wherein the third window displays descriptive information along with the listed work units, and wherein the descriptive information includes at least one of work unit identifiers corresponding to the listed work units, names corresponding to the listed work units, numbers of messages belonging to the listed work units, original requesters corresponding to the listed work units, and status indications corresponding to the listed work units.

12. The system of claim 7, wherein the user interface additionally includes a fourth window that displays content of at least one selected message.

13. The system of claim 12, wherein the content includes content in at least one of a JDL format, a XML format, a KQML format, a HTML format, and a FIPA ACL format.

14. The system of claim 1, wherein the user interface includes a second window displaying additional information, and wherein the displaying of information in the first and second windows is coordinated so that, when a user input is received in relation to certain information displayed in one of the windows, at least some of the information displayed in the other of the windows is varied.

15. The system of claim 14, wherein the user interface displays each of a second window capable of displaying a first list of messages, a third window capable of displaying work units, and a fourth window capable of displaying message content, and

wherein when the user input is a selection of one of the messages listed on the second window, the third window then displays at least one work unit corresponding to the selected message, the fourth window displays corresponding content of the selected message, and the first window displays at least a portion of a workflow of the at least one work unit.

16. The system of claim 1, further comprising a filter, wherein the filter is capable of at least one of:

causing at least one of the first window and a second window to display only a subset of the first plurality of agents; and

causing at least one of the first and second windows to display only a subset of messages occurring among the first plurality of agents.

17. The system of claim 1, wherein the user interface is capable of displaying in addition to the first window, a second window that provides information regarding at least one agent characteristic, and wherein the information displayed in the second window is capable of being altered in response to user commands provided by a user input device selected from the group consisting of a

mouse, a keyboard, a touch screen, a voice-response unit, a touch pad and an alternate input device.

18. The system of claim 17, wherein the information regarding the agent characteristic includes at least one of an agent name, an agent address, an agent filtration, an agent status, an amount of debugging information, an agent capability, and a proportional usage, and wherein an alteration in the information can be
5   provided to a related agent of the multi-agent system.

19. The system of claim 1, wherein the user interface is capable of displaying, in at least one of the first window and a second window, statistical information regarding amounts of communication occurring among the first plurality of agents.

20. The system of claim 19, wherein the amounts of communication are calculated based upon one of sums of numbers of messages and sums of bytes communicated per unit time, and wherein the statistical information can be limited to a subset of statistical information corresponding to at least one of an agent subset,
5   a message subset and a time period.

21. The system of claim 1, wherein the user interface displays information in at least one of a on-line mode of operation and an off-line mode of operation, wherein in the on-line mode of operation the information that is displayed by the user interface concerns operations of the multi-agent system that are presently
5   occurring, and wherein in the off-line mode of operation the information that is displayed by the user interface concerns operations of the multi-agent system that have already occurred.

22. The system of claim 2, further comprising a memory device on which is stored agent operational information that can be used later by the system when operating in the off-line mode.

23.   A distributed control system comprising:

a network;

a plurality of controllers programmed with a plurality of agents, wherein the controllers are in communication with one another by way of the network; and

5   a terminal coupled to the network and capable of providing a human machine interface (HMI),

wherein the HMI displays a plurality of windows on which are displayed information regarding at least some of the agents, a plurality of messages communicated among at least some of the agents, and a workflow occurring among

10   at least some of the agents.

24.   The distributed control system of claim 23, wherein the displayed information regarding the workflow occurring among at least some of the agents is displayed in a tree-type format.

25.   The distributed control system of claim 23, wherein the information displayed in one of the windows changes when a user input is received causing a change in another of the windows.

26.   The distributed control system of claim 25, wherein the plurality of windows includes at least two of a first window that displays a workflow, a second window that displays a list of messages communicated among at least some of the agents, a third window that displays a list of work units, and a fourth window that

5   displays message content.

27.   The distributed control system of claim 25, wherein the terminal is further capable of at least one of:

modifying the displayed information in accordance with a filter;

displaying an additional window in which are displayed a plurality of agent

5   characteristics; and

displaying statistical information regarding communication load.

28.   A method of interacting with a multi-agent distributed control system employing a plurality of controllers on which are programmed a plurality of agents, the controllers being coupled by a network, the method comprising:

providing a computer program capable of operating a user interface, wherein

5   the computer program is in communication with the agents via the network; and

displaying agent-related information on the user interface by way of a plurality of windows, wherein within a first of the windows is further displayed a workflow among at least some of the agents, and within a second of the windows is further displayed at least one of a plurality of messages communicated among at

10   least some of the agents, a work unit requested by at least one of the agents, and message content associated with at least one of the messages.

29.   The method of claim 28, wherein the agent-related information displayed on the user interface is at least one of information concerning current operation of the agents and information concerning past operation of the agent, wherein when the agent-related information concerns past operation of the agents,

5   the agent-related information is obtained from a storage device that has recorded the information during the past operation go the agents.

30.   The method of claim 28, wherein the information displayed in one of the first and second windows changes when a user input is received causing a change in the other of the first and second windows.